

**POSITIVE AND NEGATIVE REINFORCEMENT, A
DISTINCTION THAT IS NO LONGER NECESSARY;
OR A BETTER WAY TO TALK ABOUT BAD THINGS¹**

Jack Michael
Western Michigan University

THE DEVELOPMENT OF TECHNICAL TERMINOLOGY

Technical verbal practices evolve as a result of the behavior of specialists with respect to their subject matter and each other. Ultimately increased effectiveness of the verbal community is the primary determiner of such developments, but as in the case of biological evolution there are many nonfunctional factors that may exert a short term effect, at least. The verbal behavior of a prestigious figure may be adopted and propagated because of his accomplishments in other areas than the one in which the term occurs. Verbal distinctions may be useful to a speaker for reasons other than his relationship with his scientific subject matter. For example, they may identify him as a member of a prestigious subgroup. More to the point, some terminological distinctions may be quite functional during the development of a field because of their relations to other concepts; and then, when these other concepts change, the distinction may persist in the repertoires of the individual scientists simply because the effort required to change is considerable and the reinforcement too delayed.

While it is true that cultural evolution rather than social agreement seems to be the most important determiner of terminological developments, still we seem able to alter or hasten this evolutionary process to some extent by talking about our verbal practices. This is, of course, the essence of the areas called "philosophy of science" and "scientific methodology," and it is also the premise underlying what I have to say here. I hope to alter our current usage, or rather to hasten a change which seems to be already under way, by identifying some of the factors responsible for the original distinction between negative and positive reinforcement, and suggesting why these factors are no longer relevant.

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A BRIEF HISTORY OF THE DISTINCTION BETWEEN POSITIVE AND NEGATIVE REINFORCEMENT

A reasonable starting point for the experimental and applied analysis of behavior is the book by B.F. Skinner, *The Behavior of Organisms*, published in 1938. In the first chapter he discusses the need for a set of terms, and gives his reasons for not readily adopting popular terms.

The important objection to the vernacular in the description of behavior is that many of its terms imply conceptual schemes. I do not mean that a science of behavior is to dispense with a conceptual scheme but that it must not take over without careful consideration the schemes which underlie popular speech. The vernacular is clumsy and obese; its terms overlap each other, draw unnecessary or unreal distinctions, and are far from being the most convenient in dealing with the data. They have the disadvantage of being historical products, introduced because of everyday convenience rather than that special kind of convenience characteristic of a simple scientific system.

Terminological developments with respect to reflexes and what Skinner called "respondent conditioning" had already taken place, and some of this terminology was applicable to the type of behavior that was affected by its consequences — Skinner's "operant behavior." The layman's terms for effective consequences were "reward" and "punishment," but these terms obviously suffered from some of the disadvantages mentioned in the quote above. "Reinforcement" was at that time widely used to refer to the unconditioned stimulus of respondent conditioning, since it "reinforced" or strengthened the relationship between the conditioned stimulus and the relevant response. This term, then, was a reasonable substitute for "reward" since the effect of a reward was to increase the future probability of the response in the particular situation, or to "strengthen" the response. But how should one refer to the other half of the consequence continuum, the "bad" things? "Punishment" seemed at that time to have some of the same disadvantages as "reward" and a substitute was obviously needed. Skinner's solution can be seen from the following passage which introduced the topic of operant conditioning:

The second type of conditioning, in which the reinforcing stimulus is correlated with a response, may be represented as follows:

$$s.R^0 \rightarrow S^1 .R^1$$

where $s.R^0$ is some part of the unconditioned operant behavior of the organism and S^1 is again a reinforcing stimulus. The requirements for conditioning are some considerable strength of S^1 R^1 and the connection indicated by \rightarrow . The effect is a change in $[s.R^0]$, which may be either an increase or, possibly, a decrease. In the present example of pressing a lever the strength may increase if S^1 is, for example, food, and it may decrease if it is, for example, a shock.¹ There are thus two kinds of reinforcing stimuli — positive and negative. The cessation of a positive reinforcement acts as a negative, the cessation of a negative as a positive. Differences between the two types of conditioning will be

summarized later. (1938), pp. 65-66) [The footnote shown after "shock" said "But see the sections on negative reinforcement in this and the following chapter."]

In other words, "reward" and "punishment" were replaced by "positive" and "negative reinforcement." This is quite clear from the passage quoted, and the equating of what we now call the punishment operation with negative reinforcement occurs consistently throughout the 1938 book. For example, in the description of the now famous "bar-slap" experiment he says:

The first experiment concerns the effect of negative reinforcement upon extinction. Extinction curves after periodic reinforcement with food were obtained from four rats. On the third day the slapper was connected for the first time at the end of twenty minutes, and all responses made during the rest of the hour and on the following day were negatively reinforced. (1938, p. 15 1)

Although this terminological device successfully eliminates some of the disadvantages of the vernacular it introduces a new clumsiness of its own, the ambivalence that results from two-word terms where the two words are controlled by variables that are in some sense opposite or incompatible with one another. "Reinforce" is synonymous with "strengthen" in a number of usages, and although "negatively strengthen" as a synonym for "weaken" is not logically unreasonable, it is somewhat confusing, as would be such a term as "positively weaken." This ambivalence did not seem to cause much trouble in 1938, however, probably because Skinner's orientation was of interest only to specialists. A different version of this problem became more serious 15 or 20 years later, when Skinner's revised approach (explained below) was being taught to college freshmen.

The substitution of "negative reinforcement" for "punishment" also left standing an increasingly serious problem inherent in both terms, the identification of an important independent variable by an operation which was of dubious behavioral effectiveness, or at least quite complex. Positive reinforcing stimuli were those whose occurrence increased the probability of the behavior that they followed — a simple and noncontroversial identifying operation. Negative reinforcing stimuli were those whose occurrence decreased the probability of the behavior that they followed, but by 1938 Skinner had evidence available which was not compatible with a simple interpretation of this effect. This consisted in the results of several experiments involving the presentation of a negative reinforcing stimulus contingent upon a lever-pressing response during extinction after fixed interval positive reinforcement. The theoretical analysis is in terms of the later discarded concept of the reflex reserve, but even so, the implications of the results are quite clear.

To sum up, the experiments on periodic negative conditioning show that any true reduction in reserve is at best temporary and that the emotional effect to be expected of such stimulation can adequately account for the temporary weakening of the reflex actually observed. (p. 157)

The next major landmark in the development of the field of behavior analysis was the publication in 1950 of *Principles of Psychology*, the highly influential introductory text of F.S. Keller and W.N. Schoenfeld. The line of experimentation begun by Skinner questioning the permanence of the weakening effect of negative reinforcing stimuli had been followed up by Estes (1944), whose work generally supported Skinner's earlier conclusions. Chapter Three of the Keller and Schoenfeld text is called "Operant Conditioning," and near the end of the chapter is a section entitled "Positive and Negative Reinforcement," where the concepts are introduced as follows:

Thorndike, in his 1911 statement of the law of effect, spoke of the strengthening effect of "satisfaction" upon the bond between situation and response. Today, avoiding controversy about the nature of "satisfaction," we would say that the food he gave to his cats for opening a problem-box door was *positively* reinforcing. On the observational level, this would mean exactly what Thorndike meant — that the effect of the food was to increase the frequency of the response that produced it. We know, too, that water, for a thirsty animal, would have had a similar effect. Food and water belong to a class of positive reinforcers.

This is not all that Thorndike said. He spoke also of the weakening effect of "discomfort" upon situation-response connections. Certain stimuli (electric shocks, loud sounds, strong lights, etc.) serve to *decrease* the frequency of responses in the wake of which they follow. Nowadays, we call them *negative* reinforcers, but they are not best defined in terms of their weakening function. By 1932, Thorndike himself argued that "rewards" and "punishments" are not opposed to each other in the manner implied by his earlier formulation; and we shall offer evidence, in the next chapter, to show that the weakening effect of negatively reinforcing stimuli is not permanent.

Another, and probably a better, way of handling the matter is to define *positive* reinforcers as those stimuli which strengthen responses when *presented* (e.g., food strengthens bar-pressing or loop-pulling behavior), and *negative* reinforcers as those which strengthen when they are *removed*. (Keller and Schoenfeld, 1950, p. 61)

The evidence presented in their next chapter consisted in the results of Skinner's earlier experiments plus the findings of Estes.

The impermanence of the weakening effect of a negative reinforcing stimulus which is being referred to by Skinner and by Keller and Schoenfeld requires a little further explanation. It was, of course, recognized that the strengthening effects of positive reinforcement were temporary in the sense that the occurrence of the previously reinforced response without its reinforcement — the operation referred to as "extinction" — would result in a decrease in the response frequency. It was not expected that the weakening effects of negative reinforcement would be any more permanent in this sense: when the response occurred without being followed by the negative reinforcer the effects of the negative reinforcement would "wear off." But the weakening effects of negative reinforcers showed an additional type of impermanence which was not thought to characterize the strengthening effects

of positive reinforcers. Keller and Schoenfeld describe the critical finding as follows:

. . . Estes found that when bar-pressing was punished in the usual way during a short period of extinction, and this was followed by a two-hour period in which the rat was left in the response chamber, *with no bar present and no further punishment*, the effect of the shock was almost entirely absent when the bar was re-introduced and extinction was resumed. Leaving the rat in the chamber without the bar led to a nearly complete dissipation of the emotional upset caused by the shock. Except for a small depression at the start, the final extinction curve was in no discernible way different from that provided by animals that had never been shocked. (p. 109)

In other words, the weakening effect of a negative reinforcer on a response could be eliminated in some other way than by the occurrence of the response without the consequence. This form of impermanence, furthermore, was seen (by Skinner and by Keller and Schoenfeld) as having important practical implications, suggesting that the widespread use of negative reinforcement to eliminate behavior was a practice of questionable value.

Returning to the issue of terminology, as can be seen from the quoted passage above, Keller and Schoenfeld were by 1950 much more willing to use the term "punishment" than Skinner had been in 1938. In one instance (probably because of the introductory nature of their text) they even seemed to prefer "punishment" to "negative reinforcement," where they relabeled two of Skinner's figures "The effect of punishment . . ." which he had called "The effect of negative reinforcement, . . ." (Figures 28 and 29 of the Keller and Schoenfeld text, on pages 107 and 108; Figures 45 and 47 of Skinner's *The Behavior of Organisms*, pages 152 and 154).

In his own introductory textbook, *Science and Human Behavior*, published in 1953, Skinner completely reversed a part of his previous usage. In a section titled "What events are reinforcing?" he distinguishes between the two types of reinforcement as follows:

Events which are found to be reinforcing are of two sorts. Some reinforcements consist of *presenting* stimuli, of adding something — for example, food, water, sexual contact — to the situation. These we call *positive* reinforcers. Others consist of *removing* something — for example, a loud noise, a very bright light, extreme cold or heat, or electric shock — from the situation. These we call *negative* reinforcers. In both cases the effect of reinforcement is the same — the probability of response is increased. (p. 73)

The relationship of these events to punishment is described in a later section, immediately after the reality of the supposed direct weakening effect of punishment has been called into question.

We must first define punishment without presupposing any effect. This may appear to be difficult. In defining a reinforcing stimulus we could avoid

specifying physical characteristics by appealing to the effect upon the strength of the behavior. If a punishing consequence is also defined without reference to its physical characteristics and if there is no comparable effect to use as a touchstone, what course is open to us? The answer is as follows. We first define a positive reinforcer as any stimulus the *presentation* of which strengthens the behavior upon which it is made contingent. We define a negative reinforcer (an aversive stimulus) as any stimulus the *withdrawal* of which strengthens behavior. Both are reinforcers in the literal sense of reinforcing or strengthening a response. Insofar as scientific definition corresponds to lay usage, they are both 'rewards.' In solving the problem of punishment we simply ask: What is the effect of *withdrawing a positive* reinforcer or *presenting a negative*? An example of the former would be taking candy from a baby; an example of the latter, spanking a baby. (p. 184-185)

The term "stimulus" as used in behavioral analysis seems most often to refer to a static stimulus condition; a stimulus change is usually indicated by "stimulus onset" or some such expression. There is some ambiguity but this is usually not serious because of the additional information provided by the context. However, in the attempt to define the various terms relating to effective behavioral consequences any ambiguity of this sort can easily lead to more serious confusion. For this reason in the sections below I will generally use the somewhat cumbersome, but unambiguous, "static stimulus condition" and "stimulus change."

What Skinner proposes in the sections cited above is that we designate a stimulus change which strengthens behavior as "reinforcement." When the change can be described as presentation, this change should be called "*positive reinforcement*": when it can be described as withdrawal (or removal or termination) the change should be called "*negative reinforcement*."

It is convenient at this point for us to note that to describe any form of change we must at least describe the static condition existing before the change and the static condition existing after the change. For purposes of greater precision it is also usually necessary to say something about the time required for the former to be replaced by the latter, and something about any intermediate conditions. A change *consists of* nothing more than the fact that a pre-change condition is replaced by a post-change condition, in a certain temporal manner and with certain intermediate conditions. (This, of course, ignores the problems of a continuum, where the language of mathematics becomes essential.)

What Skinner proposes for the term "reinforcer," then, is that it should refer to a static stimulus component of those stimulus *changes* which function as reinforcement. When the stimulus change is positive reinforcement, that is, when the change can be identified as a presentation, then the static *post*-change condition should be called a positive reinforcer. When the stimulus change is a removal, thus negative reinforcement, the static *pre*-change condition should be called a negative reinforcer. Punishment is also a stimulus change, and consists of the reversal of those changes which we have found to be reinforcements.

The essence of Skinner's new approach, then, is that "negative reinforcement" is now applied to stimulus changes which strengthen the behavior preceding them,

whereas it previously referred to the same changes, but in the opposite direction. Although the distinction between "reinforcer" and "reinforcement" was not explicitly made earlier, "reinforcer" generally referred to the static pre-change conditions (negative reinforcer), or static post-change conditions (positive reinforcer), then as it does also in the new usage.

For a while in the late 1950's or early 1960's about half of the students of behavioral analysis were learning their basic concepts from the Keller and Schoenfeld text, and the other half from Skinner's *Science and Human Behavior*, a situation which generated considerable confusion with respect to the critical term "negative reinforcement." The confusion was especially keen when both texts were used in the same course.

In 1961 the programmed text by J.G. Holland and B.F. Skinner, *The Analysis of Behavior*, was published. It naturally continued the terminological practices that Skinner had introduced in the 1953 book, and it began to replace Keller and Schoenfeld as an introductory text, thus tipping the balance in favor of Skinner's new definition of negative reinforcement. The critical frames appear in Set 9 (beginning on page 53) and Set 37 (beginning on page 245) of the programmed text.

The situation with respect to this terminological issue has remained relatively stable since the mid-1960's, and for the adherent of Skinner's approach, since 1953.

WHAT IS WRONG WITH THE PRESENT USAGE?

"Negative reinforcement" with its opposite implications is a source of considerable confusion. Since 1953 there must have been thousands of man hours spent in the attempt to prevent the learner of behavioral terminology from equating this stimulus change with punishment, the change made in the opposite direction. It appears that Skinner's earlier usage, even though it has its own form of ambiguity, is much more compatible with our other verbal practices than the revised usage. The common sense opposition, reward and punishment, is probably responsible for a similar use involving the technical terms: if reward is positive reinforcement isn't it reasonable that punishment should be negative reinforcement? Since this usage is so natural one might be tempted to suggest a return to the older meaning of "negative reinforcement" as a solution to the problem, but we have no way of knowing at this time how common the other type of error would then become. The earlier usage was not really tested on unselected college freshmen, elementary school teachers, hospital attendants, etc. It is quite possible that we would then spend thousands of man hours trying to prevent the interpretation of negative reinforcement as a strengthening stimulus change, since reinforcements certainly strengthen in all other usages in our language.

The attempt to clarify the issue by requiring a sharp distinction between "reinforcer" and "reinforcement" is probably hindered by the fact that for most other occurrences of these suffixes our reactions to the two terms, at least the evaluative component of those reactions, are quite similar. In the case of "negative reinforcer" and "negative reinforcement" they must be quite the opposite of one

another: even though we generally dislike negative reinforcers, we should always welcome negative reinforcement: of course, we would not welcome the presentation of the negative reinforcer — a form of punishment — but once it has been presented we certainly "enjoy" its removal. This situation constitutes another uphill struggle against long standing patterns of verbal behavior, and probably causes more difficulty than it cures.

"Aversive stimulus" as a synonym for "negative reinforcer" (see the second quote from *Science and Human Behavior* above) has some advantages in terms of ordinary language usage, but synonymy is not generally desirable in the case of technical terms. If we go to some considerable trouble to restrict the usage of one term, why complicate the issue with another quite different one which must occur under exactly the same carefully specified conditions? With such synonyms there is always the possibility of subtle drifts in usage, which result in the necessity for further specification and the proliferation of unnecessary distinctions.

Another difficulty with current usage is that the critical distinction between positive and negative reinforcement depends upon being able to distinguish stimulus changes which are presentations from those which are removals or withdrawals, and these latter terms are not very satisfactory descriptions of changes. The circumstances under which we have a tendency to say "present" certainly seem to differ from those where we say "remove" in much vernacular usage, but some of these differences are irrelevant to a science of behavior, and there are a number of circumstances where the distinction is not easily made.

In much common-sense usage "present" and "remove" may serve primarily to identify the nature of the variables controlling the person who performs the action rather than the nature of the change, itself. A presenter makes a display or an exhibit, for which he is held responsible, or for which he may receive praise. He offers, for consideration, or as a gift, in which case he may turn something over to the receiver and no longer have it in his possession. "Removal" is more neutral, but it sometimes has overtones of disapproval, as in a dismissal from office, or when used as a euphemism for "assassinate." A science of behaving organisms, however, must be written in terms of the relations between behavioral changes and environmental changes: the motives or responsibilities or attitudes of the person who effects the environmental changes are generally not relevant, or if relevant, they should be described as additional aspects of the behaving organism's environment.

In other words, from the point of view of the behaving organism presentations and removals are both simply types of environmental changes. If they differ, the difference must not be based upon the variables controlling the person who causes the change. (One must, of course, make a tentative exception to this statement when considering the field of social psychology, but the trend in behavioral social psychologies has been to reduce such social factors to the same kinds of environmental events that affect the various individual organisms behaving with respect to each other.) So, when do we appropriately refer to an environmental change as a presentation and when a removal? We cannot, here rely on common-sense usage, since it is so seldom neutral with respect to the motives, etc. of the

person producing the change. We must actually look at our own behavior as scientists, since "present a stimulus" is not really ordinary usage. As indicated earlier all changes involve at least a static pre-change condition and a static post-change condition. We seem to use "present" when we wish to implicate the post-change condition as the one most relevant to behavior, or the most in need of specification. We use "remove" when the pre-change condition is the most significant one. Similarly (but not exactly) we use "present" when the characteristics of the pre-change condition can be taken for granted: "remove" when the post change conditions can be taken for granted. When we say that we present a food pellet to the rat the listener can always assume that the pre-change condition is one in which no food is available. We could say that we remove the "no-food" condition, but then the behaviorally important aspect of the change would remain to be described. When we say that we terminate a 50 volt electric shock, the subsequent "no-shock" condition can generally go without further description, but if it were described alone little information would be provided.

In other words, it appears that "present" and "remove" are abbreviations that can sometimes stand in place of a more complete description of both the pre-change and post-change condition. The abbreviation is usually possible, in the case of unconditioned reinforcements, although even here it must always be possible to infer the characteristics of both pre- and post-change conditions if we are to imply behavioral significance. Note that to describe a pre-change condition as "50 volts shock" is of no help in understanding the behavioral effect of the change. A change from 50 volts to 100 volts will certainly not strengthen the response that precedes the change: a change from 50 volts to 20 volts probably will, but not as much as a change from 50 volts to 0 volts.

WHY DO WE BOTHER?

As we find ourselves applying behavioral analysis to more and more complex human situations we find it increasingly difficult to distinguish between presenting and removing, or we find an increasing number of situations that seem to involve both. A fairly common response to this situation is to avoid making the distinction, and simply refer to the relevant environmental change as "reinforcement," without attempting to determine whether a positive reinforcer is being presented or a negative removed. One might well ask, then, why we bother making the distinction even in those cases where it can easily be made.

One possibility is that although both positive and negative reinforcement strengthen behavior, the strengthening effects are in some important way different from one another. Perhaps they have different temporal properties, or different relations with other independent variables. Perhaps it is easier to develop discriminations using one than the other. It is quite true that the various environmental changes that function as reinforcement each have unique properties that one must know about in order to predict or control behavior effectively. However, these properties seem just as relevant to the distinctions among the various kinds of positive reinforcements as between positive and negative

reinforcement. It is quite clear that for someone to replicate some particular behavioral manipulation it is not much more helpful to know that it involved negative reinforcement than to know, simply, that it involved reinforcement. The details must still be provided and without them the situation remains quite unclear.

Another possibility is that the two kinds of reinforcement involve different underlying physiological structures or processes — the posterior versus the anterior nuclei of the hypothalamus, for example. By maintaining the distinction between the two types of reinforcement at this time we may thus facilitate future links between physiological and behavioral research and theory. However, in view of the general troublesomeness of this particular distinction, the pace of developments within the field of physiology, and our past efforts to develop behavioral terminology on the basis of supposed or real physiological entities, this is not a very attractive strategy.

Still another possibility is that by maintaining this distinction we can more effectively warn behavior controllers against the use of an undesirable technique. "Use positive rather than negative reinforcement." But if the distinction is quite difficult to make in many cases of human behavior the warning will not be easy to follow; and it is an empirical question at the present time whether such a warning is reasonable — a question which many feel has not been answered. Furthermore, to maintain a distinction at the level of basic science because of its possible social implications seems a risky practice, and one that is usually avoided in other sciences when possible.

None of the reasons given above seems actually sufficient to justify making the distinction between the two kinds of reinforcement. I would like to suggest another more important function that it serves. The layman frequently finds it necessary to identify an environmental event or condition as one which he doesn't like, which he attempts to escape, or avoid. He may refer to such an event as "bad" (without the moral implications of this term), "undesirable," "unfavorable," etc., and he also has "punishment" to use as a contrast with "reward." A science of behavior also needs a way of identifying such events. "Punishment" was unacceptable as a technical term, at first for the same reasons that "reward" could not be used — too many other implications besides the simple effect of such events upon the operant behavior that preceded their occurrence. "Negative reinforcement" was a satisfactory replacement and retained the convenient sense of contrast with "positive reinforcement," the replacement for "reward."

The permanence of the effect of "bad" things on the behavior that *preceded* their occurrence, however, began to be brought into question almost as soon as this technical term for such things appeared. The results of Skinner's "bar-slap" experiments and the later experiments by Estes using electric shock suggested that any apparent weakening effect of negative reinforcement (in its early sense) was not really the weakening of the operant that preceded the negative reinforcement, but rather the strengthening of behavior which was incompatible with that operant — the "competing-response" interpretation. This being the case, it seemed much safer to identify this important type of environmental change in terms of the strengthening effect that results when the change occurs in the opposite direction

(when the negative reinforcer is removed), an effect which is essentially uncontroversial. And, as long as this removal is the critical operational definition, we might as well call *it* negative reinforcement, rather than its reversal, the essence of Skinner's 1953 revision.

So, even if the strengthening effects of the two kinds of reinforcement are identical in all respects, we need to make the distinction in order to have a name for the bad things in our world: we can call the *static* conditions whose presence we escape or avoid "negative reinforcers." But what do we call environmental *changes* that we do not like? Apparently there is a strong tendency to call them "negative reinforcement," even though this is erroneous according to current usage, since "negative reinforcement" refers to changes in the direction that we *do* like. We can call bad changes "punishment," and should, remembering that this term is defined as a reversal of a reinforcing change. It is awkward, however, to identify an event in terms of the behavioral effects of the reversal of the event, both because reversal, itself, is not always a clearly identifiable operation, and because such usage seems, as Azrin and Holz suggest (1966, p. 382) to require prior demonstration of the strengthening effect of such reversal.

THE SOLUTION

The important dates in the development of this terminological problem were 1938, when Skinner's *The Behavior of Organisms* was published; 1950, Keller and Schoenfeld's *Principles of Psychology*; 1953, Skinner's *Science and Human Behavior*; and 1961, Holland Skinner's *The Analysis of Behavior*. Now add another date signifying the beginning of the end to the problem: 1966, when N.H. Azrin and W.C. Holz summarized the results of over 5 years of operant research on punishment in their chapter in Honig's *Operant Behavior: Areas of Research and Application*. In a series of ingenious and thorough experiments Azrin and his colleagues disentangled the complexities that had marred earlier research in this field. They avoided the complexities resulting from the dependence of the effects of grid-shock punishment (used in most previous research) upon the particular topography of the animal's behavior by using as a punishing stimulus electric shock delivered through electrodes implanted in the fleshy tail region of the pigeon. They also concentrated on the effects of a punishing stimulus change on behavior which was continuing to receive reinforcement, a strategy which eliminated the confounding of the weakening effect of such a stimulus change with its novelty effect and its effect as a discriminative stimulus. (This particular confounding rendered several of the earlier experiments by Skinner and by Estes essentially uninterpretable.) Their research also had the advantages of all of the improvements in operant instrumentation and the various procedural and conceptual refinements that had occurred during the 12 or so very productive years since the works of Estes had been reported.

The general result of this new evidence is to discredit the results that were thought to be incompatible with the interpretation that punishment directly weakens the response that precedes it. The new information does not necessarily

invalidate the more complex competing-response theory, but renders it unnecessary, and thus less attractive than the simpler interpretation. In addition this body of research clarifies a number of procedural and conceptual problems that had been interfering with our understanding of the effect of punishment.

The majority of the experiments summarized by Azrin and Holz in the chapter in the 1966 text were reported originally in the *Journal of the Experimental Analysis of Behavior*, from 1959 up to 1965. If the general conclusions summarized in 1966 had any major weaknesses one would expect to see these reported in subsequent issues of this same journal, since this is where most of the research originating from the "Skinnerian" or "experimental analysis of behavior" orientation appears. A survey of the volumes of this journal which have appeared since 1966 (volumes 10 through 19) failed to reveal any refutation of any of the major conclusions bearing on this interpretation of the weakening effect of punishment, and revealed a number of reports supporting and extending the generality of this interpretation. Either the basic researchers were quite content to drop Skinner's interpretation in terms of competing responses, or have been unable to bring any experimental evidence to bear favorably on that interpretation or to question the more direct interpretation supported by Azrin's work.

So, the solution to our terminological problem is to refer to the good things as reinforcers and reinforcement, and the bad things as punishers and punishment. One set of terms refers to *changes* which have a strengthening effect on the preceding behavior; the other to changes which have a weakening effect. The distinction between two types of reinforcement, based in turn upon the distinction between presentation and removal simply can be dropped. (This does not prevent us from observing and making use of the generalization that environmental changes which have one type of effect on behavior will often have the opposite effect when the direction of the change is reversed.) The distinction between *reinforcer* and *reinforcement*, and that between *punisher* and *punishment* can generally be ignored, or simply left to ordinary usage to determine: only a *change* can function as a consequence of behavior so we do not need consequence terms for static pre or post change conditions. Finally, "aversive stimulus" can also be dropped as a technical term, since it is an unnecessary synonym for "punisher" or "punishment."

My final point will consist of a form of testimonial. My interaction with the field of behavior analysis consists mainly of teaching and public speaking, in both the basic and the applied areas. The arguments set forth above convinced me about 6 years ago to stop making the distinction between negative and positive reinforcement and to refer to the bad things as punishers and punishment. I can report that I have been able to get by quite nicely without the terms that were dropped, nor have I encountered any previously hidden implications which must be salvaged by compensatory shifts in the usage of other critical terms.

REFERENCES

Azrin, N.H., & Holz, W.C. Punishment. In W.K. Honig (Ed.), *Operant behavior: Areas of research and application*. New York: Appleton-Century-Crofts, 1966.

Estes, W.K. An experimental study of punishment. *Psychological Monographs*, 1944, 57, #263.

Holland, J.G., & Skinner, B.F. *The analysis of behavior*. New York: McGraw-Hill, 1961.

Keller, F.S., & Schoenfeld, W.N. *Principles of psychology*. New York: Appleton-Century-Crofts, 1950.

Skinner, B.F. *The behavior of organisms*. New York: Appleton-Century-Crofts, 1938.

Skinner, B.F. *Science and human behavior*. New York: Macmillan, 1953.